

# Small Form Factor Committee Specification of

Revision 1.0  
January 5, 1996  
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## Errata for ATAPI for CD-ROMs

## SFF-8028

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**Member Companies Voting Against This Specification:**

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## Annex C SFF8028 Errata

The following list of errata does not include minor edits related to spelling or format. SFF8028 available via FaxAccess 408 741-1600.

### C-1 Table 1, Page 5

Errata document Changed to reference SFF8028.

### C-2 Section 1.12, page 7

The Change History for SFF8020i Version 2.6 has been added.

#### 2.5 to 2.6 November 1995

- Clarification of Byte Count Register Usage for Packet Commands.
- Clarification of back-to-back data transfers
- SRST allowed to be used during Power Management of ATAPI Devices
- SRST use of the PDIAG signal is clarified
- Clarification of error condition for truncating data when allocation is non zero.
- Error code returned when loading a slot with no disc present has been changed from 05/24 to 02/3A.
- Table 65, CD-ROM Capabilities and Mechanical Status Page Format, now defines bytes 2 and 3, for new CD media type functions.
- Clarification of CD-ROM Medium Type Codes, Table 56.
- Block Error Flag byte defined as the OR of all C2 Error Bytes.
- Table 120, ISRC Format, byte definitions have been changed.
- Added table for TOC TRACK DESCRIPTORS.
- Section 3.3.49, Track Relative Logical Address, has been removed.
- Bytes 2 and 3 of INQUIRY command changed to “reserved.” References to EVPD removed.
- READ TOC command - Format field now includes Byte 2.
- READ TOC Data Format and MSF usage clarified.
- Back-to-back data transfers sequence description added. State diagrams updated.
- SRST PDIAG sequence added.
- Changer functions for delayed load have been clarified.
- Identify Drive Data has been clarified.
- Identify, Additional length information has been clarified.
- Reporting of Errors for Mode Select has been clarified.
- The SSS and SDP bits in the Mode Sense Capabilities Page have been moved.
- Block Length returned for Read CD-ROM Capacity has been clarified.
- Length of data returned for Read TOC commands have been clarified.

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**C-3 Section 3.3.5, page 12**

The definition of BCD has been clarified.

**3.3.1 BCD**

Binary coded decimal: The number system used on the physical CD-ROM and CD-DA media. Numbers that use this notation have the 'bcd' suffix attached. A byte has two 4-bit values, each of which can have a value from 0 to 9. The maximum value is 99bcd (99 decimal). BCD is only used on the physical CD Media, and never to/from the host except when raw sub-channel data is returned in the data to the host.

Example: 00 01 02 03... 08 09 10 11... 19 20 21... 98 99bcd.

**C-4 Section 3.3.49, page 16**

Track Relative Logical Address definition has been removed

**C-5 Section 3.3.50, page 16**

Transition Area - minimum transition area specification has been removed.

**C-6 Section 5.1, page 21**

The ATAPI Device will respond just as defined in the ATA Standard. The DASP and PDIAG signals will only be utilized following a POR or hardware reset condition. Although the ATA SRST is not used for initialization by ATAPI devices, the "Software reset" defined in the ATA Standard *shall* be utilized.

**C-7 Section 5.4, page 22**

Byte Count Register Usage for Packet Commands paragraph 3 changed to:

The Host has the capability to limit the number of bytes transferred on each DRQ. This limit is communicated to the Device in the Byte Count Register when the Packet Command is issued. The Release is intended to be used only on Block Boundaries and since this DRQ limit could then cause a Release in the middle of a block (if the limit is set smaller than the amount of data to be transferred for one sector), the minimum size of the DRQ limit *shall* be no smaller than the length of data to be transferred for one sector from the media. This limitation would only be valid for Media Access commands and not applicable to Mode Sense, Inquiry, etc. If the byte count is odd and the amount of data to be sent is larger than the limit, then the amount of data sent on each DRQ *shall* be less than the specified value as a drive *shall* not send odd length DRQs, except for the last transfer. Given this, the odd byte count transfer limit in the BC registers cannot be used. The device *shall* always round down the value to the next lower even number, unless the transfer length matches the actual total transfer length exactly.

When a Read command is being processed, the ATAPI Device may wish to send all the data that is available in its buffers on just one DRQ Interrupt, with the limitation that only 65534 bytes may be transferred at one time.

Remove: "For all commands that can transfer all the data in one DRQ Interrupt, the Byte Count shall contain the total data length." (beginning 5th paragraph)

**C-8 Section 5.6, page 23**

Replace the first two bullets with:

- ATA commands operate differently from packet commands. When a new ATA command is written to the Command

Register, before a command has completed, the executing command stops execution and the new command is aborted with an Aborted Command error.

- If after reporting completion of an Immediate Mode command (Seek, Play Audio, etc.) the device receives a new command before actual completion of the execution of the prior command, the device *shall* accept the new command and execute it when able.

### C-9 Section 5.8, page 25

Changes to the flow steps:

10. When the Device is ready to present the status, the Device places the completion status into the Status Register, sets CoD, IO, DRDY and, prior to asserting INTRQ, clears BSY and DRQ.
11. After detecting INTRQ & DRQ=0 the host reads the Status Register and if necessary, the Error Register for the command completion status.

The DRQ signal is used by the device to indicate when it is ready to transfer data, and is cleared during the last byte of data to be transferred. This applies for both Command Packet as well as normal read/write data.

### C-10 Section 5.10, page 30

The last sentence of point 4 has been removed (BSY before and After).

### C-11 Section 5.9 & 5.11, pages 27 & 32

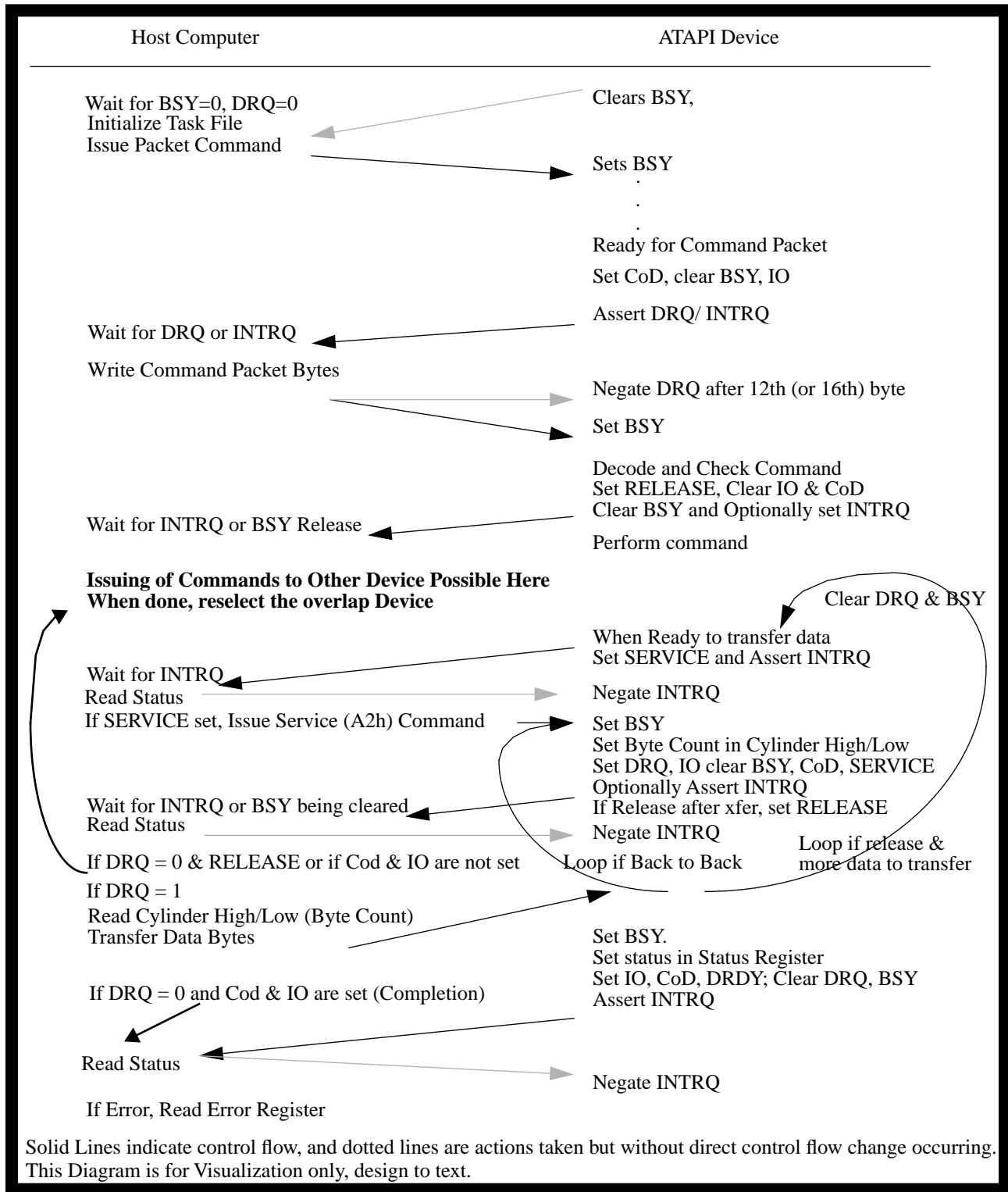
Sections 5.9 & 5.11 Flow of Overlapped Commands with Data Transfer: Back-to-back data transfers sequence description added. State diagram updated.

12. When the Device receives the Service Command or if moving directly from Packet Command Data to Data Transfer or from Back-to-Back Data Transfers, the Device (1) places the byte count of the data available into the Cylinder High and Low Registers, (2) clears SERVICE, (3) sets IO and clears CoD, (4) sets DRQ and clears BSY. If the Device has been previously commanded to generate an interrupt when done processing the Service Command, the Device *shall* set INTRQ (1).
13. After detecting INTRQ or that BSY has been cleared, the host reads the DRQ bit in the Status Register to determine how it will proceed with the command. If DRQ= 0 then the device has either released the ATA Bus or terminated the command. If DRQ=1 then the host *shall* read the data (number of bytes specified in the Cylinder High/Low Registers) via the Data Register. In response to the Status Register being read, the Device negates INTRQ for both cases.
14. If no more data is to be transferred, proceed to step 19.
15. One of two possibilities exists, either Release or back-to-back data transfers. If Release, proceed to Step 17.
16. The device (1) sets Busy; (2) clears DRQ; and (3) the Release bit is cleared. The IO CoD bits remain the same. Proceed to step 12.
17. The Device (1) leaves BSY cleared, (2) clears DRQ. The RELEASE Bit *shall* have been set at the beginning of the last data transfer. The IO and CoD bits *shall* remain in the same state as for a normal data transfer, this distinguishes the "Release" from a "Status" state.
18. The above sequence is repeated from step 9.
19. The Device clears DRQ and sets BSY.

Statement removed: "DRQ may be set before or AFTER BSY has been deasserted; however, DRQ will not be visible until BSY=0."

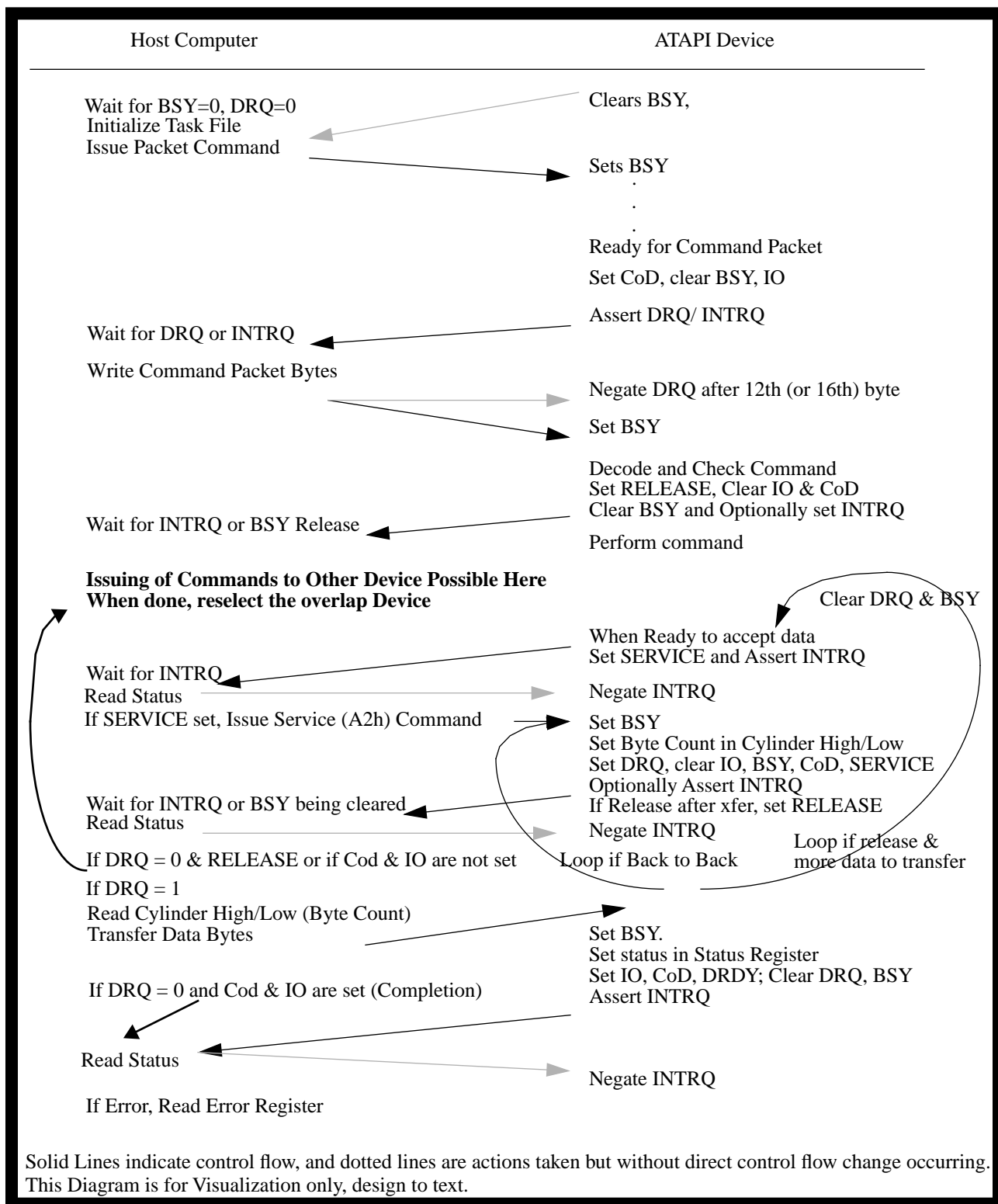
C-12 Section 5.9 Figure 3, page 29

Replace the flow diagram with:



C-13 Section 5.11 Figure 5, page 34

Replace the flow diagram with:



### C-14 Section 5.11, page 33

Replace the point 13 with the following:

13. After detecting INTRQ or that BSY has been cleared, the host reads the DRQ bit in the Status Register to determine how it will proceed with the command. If DRQ= 0 then the device has either released the ATA Bus or terminated the command. If DRQ=1 then the host **shall** write the data (number of bytes specified in the Cylinder High/Low Registers) via the Data Register. In response to the Status Register being read, the Device negates INTRQ for both cases.

### C-15 Section 5.16, page 38

Remove “3. DRQ may be set before or after BSY has been deasserted” and make the following changes:

The order that the signals change **shall** adhere to the following conditions:

1. Upon receiving the A0h ATAPI Packet Command the Device **shall** have BSY asserted until the next host access of the Status Register where the device can guarantee that CoD=1 and IO=0.
2. The Device **shall** not assert DRQ until CoD and IO are valid for the command or data packet to be transferred and the device is ready to perform that transfer.
3. The Device **shall** clear BSY and set DRQ within the time-out specified by the CMD DRQ Type. See section 7.1.7.1, “General Configuration Word (0)”, on page 63 for additional information.
4. Devices reporting CMD DRQ Type “Accelerated” **shall** de-assert DRQ within 5 $\mu$ s of the last word transferred for a command or data packet unless Back-to-Back Data Transfers in an overlapped mode are performed.
5. Devices reporting a CMD DRQ Type other than “Accelerated” **shall** de-assert DRQ, before asserting INTRQ, following the last word transferred for a command or data packet.

### C-16 Section 5.17, page 39

Remove bullet “Once the Service (A2h) command has successfully completed the host may service the device’s interrupt as if the device were the only device on the ATA Bus.”

Modify last bullet: “At the completion of data transfer or within 5 $\mu$ s, either a Release or a Back-to-back data transfer **shall** be initiated.”

### C-17 Section 5.17.1 & 5.17.2, page 40

Make the following changes:

The Release after the transfer of data **shall** be performed by hardware for all data transfer operations and as such there is no Interrupt generated after the release when transferring data. An optional Back-to-Back Data Transfer without a Release or IRQ can be used by a device.

#### 5.17.2 Service Command (A2h)

The Arbitration of the Task File Registers is performed by logic outside of the Devices attached to the ATA Cable. The basic premise is that the Device releases the use of the Task File Registers when it is processing the command and no longer needs the registers. This of course makes it difficult to place the arguments for the Interrupt into the registers as

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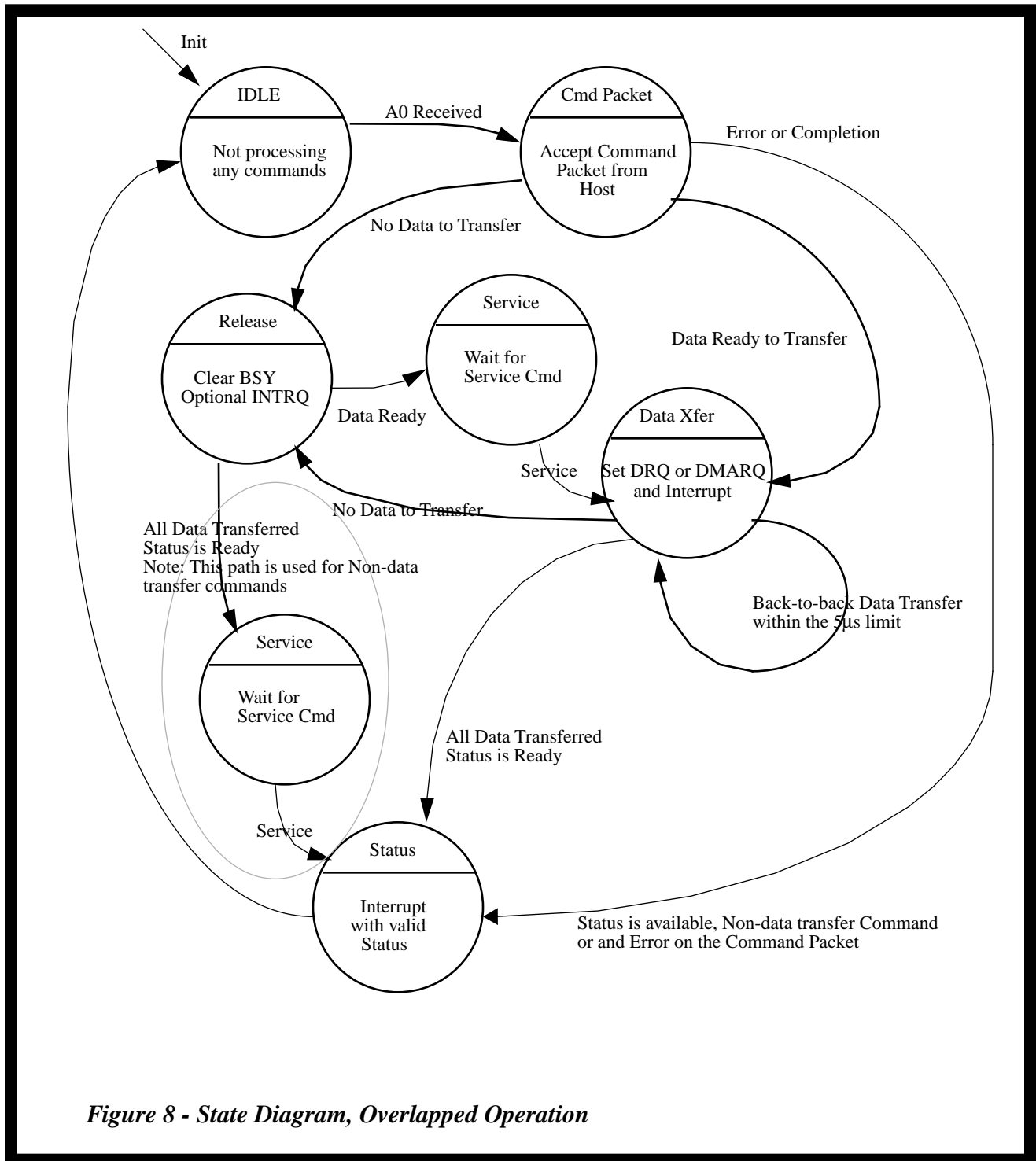
the device no longer owns them. The Service command essentially hands the registers back to the device so that the correct parameters can be placed into them. These parameters include the Byte Count, and Interrupt Reason.

The Clearing of Busy after the Service Command *shall* only occur after the parameters for the Interrupt are loaded into the Task File Registers. Thus for a hardware implementation of this Clearing of Busy, there should exist a separate set of information for these parameters e.g. Byte Count, Interrupt Reason, Status. Note, in the future, acceleration of the Service Command will become very important to the overall system performance when using overlap. It is highly recommended that the time required to perform the Clearing of Busy after the SERVICE Command is less than 5 $\mu$ s.

When an overlapped command requests service the Host Driver is responsible for determining which device should be serviced, and then issuing the Service Command. This causes the device to place information on the reason for the service into the Task File registers.

C-18 Section 5.17.3 Figure 8, page 43

Replace the figure with:



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**C-19 Section 5.18.2, page 46**

Make the following changes:

The SRST bit in the ATAPI Device Control Register (See “Table 17 - ATAPI Device Control Register (ATA Device Control Register)” on page 57) *shall* NOT be used by the ATAPI Driver (except for power management when SRST is used to wake up an ATAPI device). Instead the ATAPI Device Driver *shall* reset the ATAPI Device utilizing the ATAPI Soft Reset command (see “6.2 ATAPI Soft Reset Command and Protocol” on page 50). Resetting the ATAPI Device using the ATA SRST would also reset any ATA hard drive attached, and if there are separate Drivers for an IDE and an ATAPI device, each driver would be resetting the others peripheral without the other driver being aware of the reset.

**5.18.2.1 SRST Sequence Device 0**

1. Host sets SRST bit to one.
2. Device 0 sets BSY within 400 nsec.
3. Device 0 Posts diagnostic results in the Error Register.
4. Device 0 waits for the Host to clear SRST to zero.
5. If Device 0 detected that Device 1 is present during the most recent power on or hardware reset sequence, then Device 0 waits up to 31 seconds from the time that SRST bit became zero for Device 1 to assert PDIAG-. If PDIAG- is asserted within 31 seconds, Device 0 clears bit 7 of the Error Register to zero, else Device 0 sets bit 7 equal to one in the Error Register. If Device 1 was not detected in the most recent power up or hardware reset sequence, then Device 0 clears bit 7 of the Error Register to zero.
6. Device 0 loads the ATAPI Signature into the Task File Registers.
7. Device 0 Clears the BSY bit to zero when ready to accept commands within 31 seconds after the SRST bit was cleared to zero.

**5.18.2.2 SRST Sequence Device 1**

1. Host sets SRST bit to one.
2. Device 1 sets BSY within 400 nsec.
3. Device 1 negates PDIAG- within 1 msec after SRST is set to one.
4. Device 1 Posts diagnostic results in the Error Register.
5. Device 1 waits for the Host to clear SRST to zero.
6. Device 1 loads the ATAPI Signature into the Task File Registers.
7. Device 1 Clears the BSY bit to zero when ready to accept commands within 31 seconds after the SRST bit was cleared to zero.
8. If Device 1 didn't post any error, assert PDIAG-, else optionally assert PDIAG-.

**C-20 Section 6.1.1 Figure 10, page 50**

Replace the figure with:

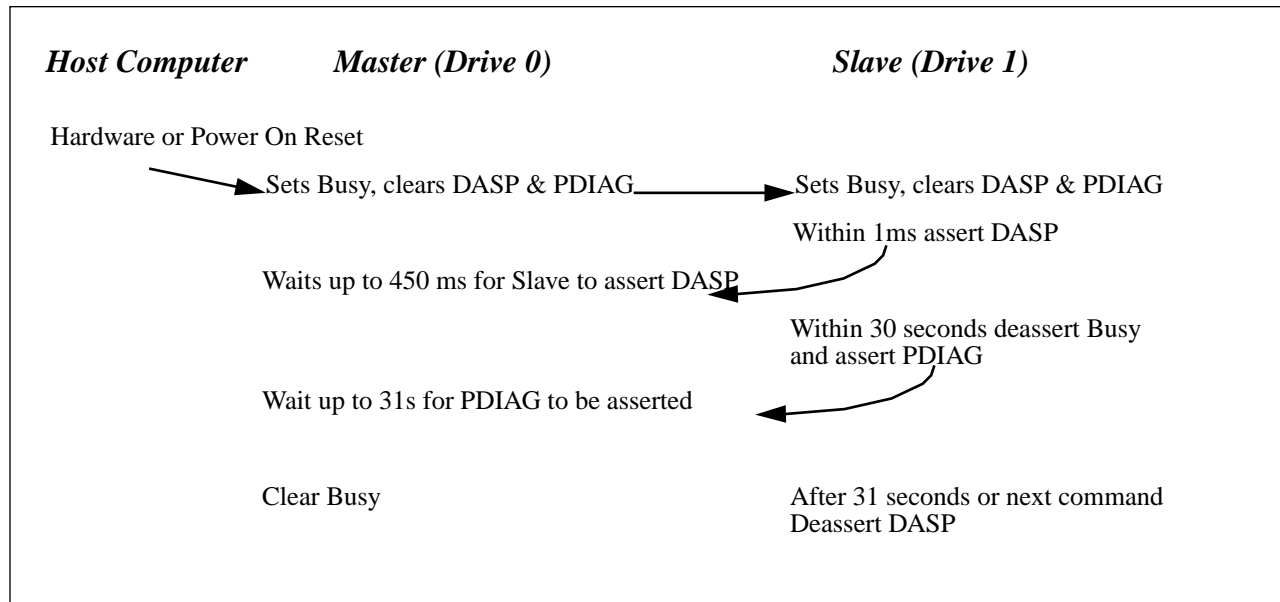


Figure 10 - DASP / PDIAG Sequence after Hardware Reset or Power On

### C-21 Section 6.3, page 51

Replace the points 3 - 7 with the following:

1. Perform SRST PDIAG sequence see "5.18.2 SRST Initialization Sequence" on page 46.
2. Initialize the task file with Status = 00h or 10h, Error = According to SRST Sequence, Sector Count = 01h, Sector Number = 01h, Cylinder Low = 14h, Cylinder High = EBh and Drive/Head = 00h. Note that Device 0 will be selected after the completion of the SRST sequence.
3. The functionality of the DRDY and DSC bits shall be restored on the first command following an SRST.
4. Continue executing commands or play operations.
5. Leave Mode settings or Set Feature settings unchanged.
6. If a selected ATAPI Device detects SRST while its own DRQ or BSY is set (1), then the command in progress *shall* be stopped.

### C-22 Section 6.5, page 53

Make the following change to the last paragraph:

**Implementer's Note:** Drive 0 (Master) is able to determine if Drive 1 (Slave) is present, but Drive 1 can't determine if Drive 0 is present. Drive 0 will see the Slave drive assert the DASP- signal during the Reset procedure, which indicates that the Slave is present.

**C-23 Section 7.1.7, page 62**

Change the definition in table 19 for word 49 to the following:

49	Capabilities: LBA bit <i>shall</i> be supported; DMA, IORDY, Overlap and Standby bits are optional.	Mandatory
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**C-24 Section 7.1.7.5, page 65**

Replace Table 21 with the following:

**Table 21 - Identify Drive Data - Capabilities Word (49)**

Bit Byte	7/15	6/14	5/13	4/12	3/11	2/10	1/9	0/8
0	Vendor Unique							
1	Reserved for Inter- leaved DMA Sup- ported	Reserved for Proxy Interrupt Supported	Overlap Operation Supported (Optional)	Reserved	IORDY Supported (Optional)	IORDY can be dis- abled (Optional)	LBA Sup- ported (Manda- tory)	DMA Sup- ported (Optional)

**C-25 Section 7.1.7.17, page 67**

Replace the section header 7.1.7.17 with the following:

**“7.1.7.17 Typical Time for the Clearing of Busy After SERVICE Command (Word 72)”**

**C-26 Section 7.1.16, page 67**

Replace the nanosecond reference with microseconds.

**C-27 Section 7.1.8, page 67**

Service - add new paragraphs:

Upon receipt of the Service command the device shall clear the SERVICE bit before it de-asserts BSY (See "7.1.8 Service" on page 67).

Completion of the Service Command is different than all other commands. It occurs when the state of the “Task File” registers has been restored to the state they would be in if no release had occurred. In this case, the Busy bit shall be cleared.

**C-28 Section 7.1.9, page 68**

Change foot notes of Table 23 to be valid only when Overlap is supported.

**C-29 Section 8.2, page 71**

Remove all references to Track Relative Locical Addresses.

***C-30 Section 8.5, page 77***

Add sentences to end of section: “The drive *shall* spin up and make the disc ready for media accesses when a new disc is detected.”

“Any media access when the drive is not spinning *shall* spin the drive up and not generate an error.”

***C-31 Section 8.5.1 - Table 26, page 78***

Not Ready Error Reporting - Remove “READ CD TRACK/INDEX” from the table.

***C-32 Section 8.6 , page 79***

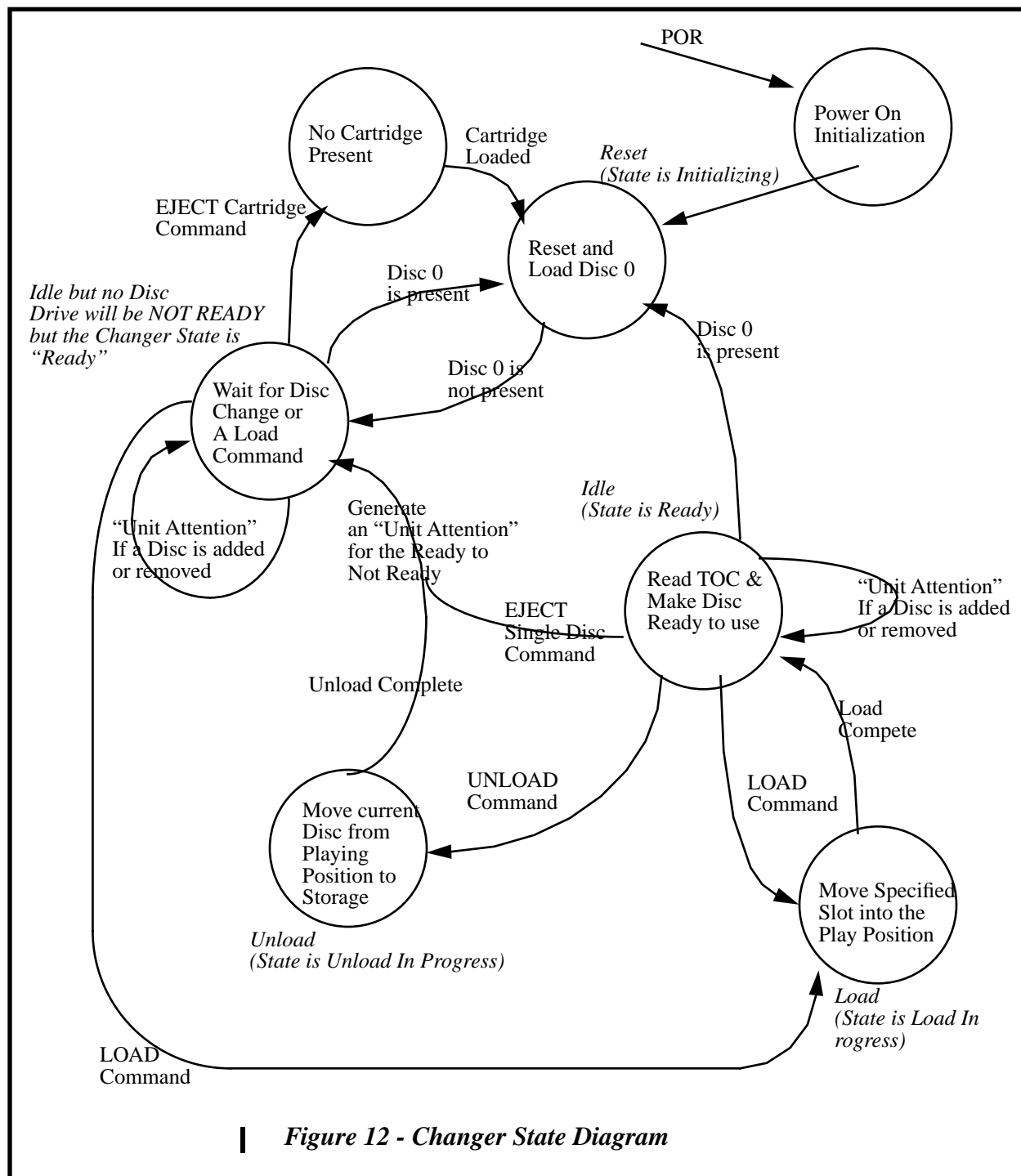
Remove the sentence that begins with: “This track relative logical...” at the top of the page.

***C-33 Section 9.0, page 81***

Change the opcode B8h to BDh.

C-34 Section 9.1, page 82

Replace the figure with the following:



C-35 Section 9.4, page 83

Add the following paragraphs after 9.3:

#### 9.4 Delayed Disc load operation

CD Changer Devices may either move a disc into the playing position immediately upon receipt of a LOAD command, or delay the loading of the disc until a media access command is received. It is recommended that the device not load discs into the playing position until data from a disc that is not cached is requested from the host.

Note that Host Drivers should expect to encounter load mechanism delays on media accesses in addition to the spin up and seek delays normally introduced with these commands.

If the device supports delayed loading and the selected disc is not in the play position, then the following commands *shall* move the selected disc into the play position When data that has not been cached has been requested by the host:

**Table 156 - Commands that may cause delayed loads to occur**

Command
Play Audio (10)
Play Audio MSF
Play CD
Read (10)
Read (12)
Read CD
Read CD MSF
Read CD-ROM Capacity
Read Header
Read Sub-Channel
Read TOC
Scan

If the device supports delayed loading and the selected disc is not in the play position, then the following commands shall load the selected disc into the play position before execution of the command:

**Table 157 - Commands that will cause delayed loads to occur**

Command
Seek
Start/Stop Unit (LoEj=1)

If the device supports delayed loading and the selected disc is not in the play position, then the following commands shall not move the selected disc into the play position:

**Table 158 - Commands that should not cause delayed loads to occur**

Command
Stop Play / Scan
Start/Stop Unit (LoEj=0)
Test Unit Ready
Inquiry
Mechanism Status
Mode Select
Mode Sense
Prevent / Allow Medium Removal
Request Sense
Set CD Speed

### **9.5 Prevent / Allow processing**

There are two techniques for Prevent / Allow, either all the discs shall be prevented from being ejected by the user or each disc individually shall be prevented. If the device reports support for Software Slot Selection, then each slot *shall* be individually controlled by the Prevent / Allow command. Note that changer devices that use a Cartridge and not individually controlled slots should not report the Software Slot Selection capability.

### **C-36 Section 10.2.4, page 87**

Section 10.2.4 Parameter List Length - remove last sentence: "This condition shall not be considered as an error."

### **C-37 Section 10.2.5, page 87**

Modify the text to the following:

The Allocation Length Field specifies the maximum number of bytes that a Host Computer has allocated for returned data. An allocation length of zero indicates that no data *shall* be transferred. The Drive *shall* terminate the data transfer when allocation length bytes have been transferred or when all available data have been transferred to the Host Computer, whichever is less. The allocation length is used to limit the maximum amount of data (e.g. sense data, mode data, etc.) returned to a Host Computer. When data is truncated, no error is generated, except for the Mechanism Status Command that *shall* generate a Parameter List Length Error.

### **C-38 Section 10.8.1, page 91**

Inquiry Command - Remove 3 paragraphs following Inquiry Command table - description of EVPD bit. Remove Page Code field from Byte 2 in table.

### **C-39 Section 10.8.1 Table 36, page 92**

Change Additional Length field in byte 4 to: "Additional Length (n-5)".

### **C-40 Section 10.8.2, page 95**

Add a line above the SLOT byte 8 in table 39.

Change the wording in the 3rd paragraph after table 39 to:

Loading when the slot does not contain a Disc will be rejected with a Sense Key 02 (NOT READY) and Sense Code 3A (MEDIUM NOT PRESENT) for the Slot Byte.

### **C-41 Section 10.8.2, page 95**

The SLOT parameter should be in byte 8 of the packet. A line should be drawn between byte 7 and byte 8 in the table.

### **C-42 Section 10.8.2, Table 40, page 95**

The description of LoUnlo/Start = 11 is currently “Load the Media from specified slot and Read TOC”. This should be changed to read:

“Either Move the Disc in the selected SLOT to the play position or select the SLOT specified for use with future Media Access Commands”.

### **C-43 Section 10.8.2 3rd paragraph after Table 40, page 95**

The sentence that begins “Loading when the slot does not...” will be replaced with:

“Loading when the slot does not contain a Disc will be rejected with a Sense Key 02 (NOT READY) and Sense Code 3A (MEDIUM NOT PRESENT). When this error is returned there are two possible actions by the CD Changer Device. If the device reports Software Slot Selection (SSS) = 1, then the slot specified shall be selected for use. If the device reports SSS = 0 then the previously used slot shall continue to be selected for use.

If the drive is capable of caching data then a delayed load of a disc into the playing position can be supported. If delayed loading of a disc into the playing position is supported, the device SHALL have previously cached the TOC data from that disc. If the device has not read the TOC for a disc that is being loaded into the playing position, then delayed loading SHALL not be performed and the disc SHALL be loaded into the playing position immediately. If Caching of TOC data has been performed and the loading of the Disc into the playing position is delayed, then the drive SHALL report that the Disc is ready, even though the Disc is not spinning and installed in the playing position. In all cases the behavior seen by the host (other than a longer subsequent media access latency) shall not be different between delayed and immediate loading of a disc.

Note that an UNIT ATTENTION Condition *shall* not be generated when discs are loaded or unloaded from the playing position.”

### **C-44 Section 10.8.3, page 97**

Change the 2nd paragraph after table 42 to:

The ATAPI CD-ROM Drive *shall* terminate the command with CHECK CONDITION status if the parameter list length results in the truncation of any Mechanism Status header, or Slot Table page. The sense key *shall* be set to ILLEGAL REQUEST, and the additional sense code *shall* be set to PARAMETER LIST LENGTH ERROR. *Note: In the future, this error may be removed.*

### C-45 Section 10.8.3 Table 46, page 100

Recommended Sense Key, ASC & ASCQ for Mechanism Status - Add "Parameter list length error" (05-1A-00)

### C-46 Section 10.8.4, page 101

Change the last paragraph on this page to:

The ATAPI CD-ROM Drive *shall* terminate the MODE SELECT command with CHECK CONDITION status, set the sense key to ILLEGAL REQUEST, set the additional sense code to INVALID FIELD IN PARAMETER LIST, and *shall not* change any mode parameters for the following conditions:

1. If the Host Computer sets any field (except for reserved fields) that is reported as not changeable by the ATAPI CD-ROM Drive to a value other than its current value.
2. If the Host Computer sets any unreserved field in the mode parameter header to an unsupported value.
3. If an Host Computer sends a mode page with a page length not equal to the page length returned by the MODE SENSE command for that page.
4. If the Host Computer sends an unsupported value for a mode parameter and rounding is not implemented for that mode parameter.

### C-47 Section 10.8.6, page 107

Update CD-ROM Medium Type Codes:

**Table 56 - CD-ROM Media Type Codes**

Code	Medium Type Description
00h	Door closed / caddy inserted, medium type unknown
01h	120 mm CD-ROM data only, door closed or caddy inserted
02h	120 mm CD-DA audio only, door closed or caddy inserted
03h	120 mm CD-ROM data and audio combined, door closed or caddy inserted
04h	120 mm CD-ROM Hybrid disc (Photo CD), door closed or caddy inserted
05h	80 mm CD-ROM data only, door closed or caddy inserted
06h	80 mm CD-DA audio only, door closed or caddy inserted
07h	80 mm CD-ROM data and audio combined, door closed or caddy inserted
08h	80 mm CD-ROM Hybrid disc (Photo CD), door closed or caddy inserted
09h - 0Fh	Reserved
10h	Door closed / caddy inserted, medium type (CD-R) size unknown
11h	120 mm CD-ROM (CD-R) data only, door closed or caddy inserted
12h	120 mm CD-DA (CD-R) audio only, door closed or caddy inserted
13h	120 mm CD-ROM (CD-R) data and audio combined, door closed or caddy inserted
14h	120 mm CD-ROM (CD-R) Hybrid disc (Photo CD), door closed or caddy inserted
15h	80 mm CD-ROM (CD-R) data only, door closed or caddy inserted
16h	80 mm CD-DA (CD-R) audio only, door closed or caddy inserted
17h	80 mm CD-ROM (CD-R) data and audio combined, door closed or caddy inserted
18h	80 mm CD-ROM (CD-R) Hybrid disc (Photo CD), door closed or caddy inserted
19h - 1Fh	Reserved
20h	Door closed / caddy inserted, medium type (CD-E) size unknown
21h	120 mm CD-ROM (CD-E) data only, door closed or caddy inserted

**Table 56 - CD-ROM Media Type Codes (Continued)**

Code	Medium Type Description
22h	120 mm CD-DA (CD-E) audio only, door closed or caddy inserted
23h	120 mm CD-ROM (CD-E) data and audio combined, door closed or caddy inserted
24h	120 mm CD-ROM (CD-E Hybrid disc), door closed or caddy inserted
25h	80 mm CD-ROM (CD-E) data only, door closed or caddy inserted
26h	80 mm CD-DA (CD-E) audio only, door closed or caddy inserted
27h	80 mm CD-ROM (CD-E) data and audio combined, door closed or caddy inserted
28h	80 mm CD-ROM (CD-E) Hybrid disc, door closed or caddy inserted
29h - 2Fh	Reserved
30h	Door closed / caddy inserted, medium type unknown
31h	120 mm (HD) door closed or caddy inserted
32h - 34h	Reserved
35h	80 mm (HD) door closed or caddy inserted
36h - 6Fh	Reserved
70h	Door closed, no disc present
71h	Door open or no caddy inserted
72h	Door closed or caddy inserted, medium format error
73h - 7Fh	Reserved
80h - FFh	Vendor-specific

**C-48 Section 10.8.6.1 Table 57, page 108**

CD-ROM Audio Control Mode Page Format - Remove first paragraph after table 57.

**C-49 Section 10.8.6.4 Table 65, page 115**

Change the table and text to the following:

**Table 65> - CD-ROM Capabilities and Mechanical Status Page Format**

Bit Byte	7	6	5	4	3	2	1	0
0	PS	Reserved	Page Code (2Ah)					
1	Page Length (12h)							
2	Reserved					Method 2	CD-E Rd	CD-R Rd
3	Reserved						CD-E Wr	CD-R Wr
4	Reserved	Multi Session	Mode 2 Form 2	Mode 2 Form 1	Digital Port(2)	Digital Port(1)	Composite	AudioPlay
5	Reserved	UPC	ISRC	C2 Pointers	R-W De- interleaved & corrected	R-W Suported	DAAccu	CD DA
6	Loading Mechanism Type			Reserved	Eject	Prevent Jumper	Lock State	Lock
7	Reserved				S/W Slot Selection (SSS)	Supports Disc Present (SDP)	Separate Channel Mute	Separate volume

Table 65> - CD-ROM Capabilities and Mechanical Status Page Format

Bit Byte	7	6	5	4	3	2	1	0
8	(MSB)							
9	Maximum Speed Supported (in KBps)							(LSB)
10	(MSB)							
11	Number of Volume Levels Supported							(LSB)
12	(MSB)							
13	Buffer Size supported by Drive (in KBytes)							(LSB)
14	(MSB)							
15	Current Speed Selected (in KBps)							(LSB)
16	Reserved							
17	Reserved		Length		LSBF	RCK	BCK	Reserved
18	Reserved							
19	Reserved							

#### Media Function Capabilities:

If CD-R Read Field is set to one, the drive **shall** support the read function of CD-R disc (Orange Book Part II).

If CD-E Read Field is set to one, the drive **shall** support the read function of CD-E disc (Orange Book Part III).

If Method 2 is set to one, the drive **shall** support the read function of CD-R media written using fixed packet tracks using Addressing Method 2.

If CD-R Write Field is set to one, the drive **shall** support the write function of CD-R disc (Orange Book Part II).

If CD-E Write Field is set to one, the drive **shall** support the write function of CD-E disc (Orange Book Part III).

The individual capabilities of the drive are specified by bytes 4 through 7. Each of the bits indicate if that specific capability is supported. A value of zero indicates that the capability is NOT supported; a value of one indicates the capability IS supported.

Bit 0	Audio Play	The drive is capable of Audio Play operation. This also indicates that the drive is capable of overlapping Play and other commands such as reading of the Sub-channel information.
Bit 1	Composite	The drive is capable of delivering a composite Audio and Video data stream.
Bit 2	Digital Port(1)	The drive supports digital output (IEC958) on port 1
Bit 3	Digital Port(2)	The drive supports digital output(IEC958) on port 2
Bit 4	Mode 2 Form 1	The drive is capable of reading sectors in Mode 2 Form 1 (XA) format.
Bit 5	Mode 2 Form 2	The drive is capable of reading sectors in Mode 2 Form 2 format.
Bit 6	Multi Session	The drive is capable of reading multiple session or Photo-CD discs.
Bit 8	CD-DA Commands Supported	Red Book audio can be read using the READ-CD command.
Bit 9	CD-DA Stream is Accurate	This bit indicates that the drive supports an advanced feature that allows it to

		return to an audio location without losing place to continue the READ CD-DA command.
		0 The drive is incapable of accurately restarting the CD-DA read operation, and a BUFFER OVERFLOW error <i>shall</i> be reported whenever a loss of streaming occurs. This error will be fatal and the command will have to be repeated from the beginning.
		1 The drive can continue from a loss of streaming condition and no error will be generated.
Bit 10	R-W Supported	The commands that return Sub-channel data can return the combined R-W information.
Bit 11	R-W De-interleaved & Corrected	This indicates that the R-W sub-channel data will be returned de-interleaved and error corrected.
Bit 12	C2 Pointers are Supported	This indicates that the drive supports the C2 Error Pointers. This also indicates that the drive is capable of returning the C2 Error Pointers and C2 Block Error flags in the READ CD command.
Bit 13	ISRC	The drive can return the International Standard Recording Code Information.
Bit 14	UPC	The drive can return the Media Catalog Number (UPC)
Bit 16	Lock	The PREVENT/ALLOW command is capable of actually locking the media into the drive.
Bit 17	Lock State	This indicates the current state of the drive. 0 The drive is currently in the allow (Unlocked) state. Media may be inserted or ejected. 1 The drive is currently in the prevent (Locked) state. Media loaded in the drive may not be removed via a soft or hard eject. If the drive is empty, media may not be inserted if the Prevent Jumper is not present. If the jumper is present, then media may be inserted.
Bit 18	Prevent Jumper	This indicates the state of the (Optional) Prevent/Allow Jumper. 0 Jumper is present. Drive will power up to the allow state. Locking the drive with the Prevent/Allow Command <i>shall</i> NOT prevent the insertion of media. 1 Jumper is not present. Drive will power up to the Prevent State (Locked). The drive will not accept new media or allow the ejection of media already loaded until an allow command is issued.
Bit 19	Eject Command	The drive can eject the disc via the normal START/STOP command with the LoEj bit set. If the mechanism is a Changer that uses a Cartridge, then this bit indicates that the Cartridge can be ejected.
Bit 20	Reserved	Reserved
Bit 23-21	Loading Mechanism Type	This field specifies the type of disc loading the drive supports. 23 22 21 0 0 0 Caddy type loading mechanism 0 0 1 Tray type loading mechanism 0 1 0 Pop-up type loading mechanism 0 1 1 Reserved

---

1	0	0	Changer with individually changeable discs
1	0	1	Changer using a Cartridge Mechanism
1	1	0	Reserved
1	1	1	Reserved

Bit 24	Separate Volume Levels	The audio level for each channel can be controlled independently.
Bit 25	Separate Channel Mute	The mute capability for each channel can be controlled independently.
Bit 26	Supports Disc Present (SDP)	This bit indicates that the Device contains an embedded changer, and that after a reset condition or if a cartridge is changed, it can report the exact contents of the slots. The response to the MECHANISM STATUS command will contain valid Disc is Present status information for all slots.
Bit 27	Software Slot Selection (SSS)	This bit controls the behavior of the LOAD/UNLOAD command when trying to load a Slot with no Disc present.

***C-50 Section 10.8.6.4, page 117***

Change the paragraph following Table 66 to:

Note that these are the raw data rates and do not reflect any overhead resulting from headers, error correction data, etc. It is also important to understand that the reported data rate is a theoretical maximum and the actual data rates to the host will be lower. The data rates are dynamic and will change as the drive changes its speed.

***C-51 Section 10.8.6.4, page 118***

Change RCH to RCK in the definition of Bit 2.

***C-52 Section 10.8.18.3 Table 120, page 161***

Update Table 120 - ISRC Format of Data Returned to Host - Bytes 9-13 changed to 7 bits of code; bytes 2 & 3 defined as CD Function.

***C-53 Section 10.8.12, page 133***

Replace table with:

**Table 83 - READ (10) Command**

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (28h)							
1	Reserved							
2	Logical Block Address							
3								
4								
5								
6	Reserved							LSB
7	Transfer Length							
8								
9	Reserved							
10	Reserved							
11	Reserved							

**C-54 Section 10.8.14, page 137**

Change the Table 88 - Read Capacity Data, Block Length in Bytes field to return only 2048d.

**C-55 Section 10.8.15, page 141**

Replace table with:

**Table 94 - READ CD, Error Flag(s) Field Definition**

Error Flags	Definition	Description
00b	None	No Error information will be included in the data stream.
01b	C2 Error Flag data	The C2 Error Flag (Pointer) bits (2352 bits or 294 bytes) will be included in the data stream. When the C2 Error pointer bits are included in the data stream, there will be one bit for each byte in error in the sector (2352 total). The bit ordering is from the most significant bit to the least significant bit in each byte. The first bytes in the sector will be the first bits/bytes in the data stream.
10b	C2 & Block Error Flags	Both the C2 Error Flags (2352 bits or 294 bytes) and the Block Error Byte will be included in the data stream. The Block Error byte is the OR of all the C2 Error Flag bytes. So that the data stream will always be an even number of bytes, the Block Error byte will be padded with a byte (undefined). The Block Error byte will be first in the data stream followed by the pad byte.
11b	Reserved	Reserved for future enhancement.

**C-56 Section 10.8.15, page 142**

Replace tabe 96 and following text with:

**Table 96 - Number of Bytes Returned Based on Data Selection Field**

Data to be transferred	Flag Bits	CD-DA	Mode 1	Mode 2 non XA	Mode 2 Form 1	Mode 2 Form 2
User Data	10h	2352	2048	2336	2048	2328
User Data + EDC/ECC	18h	(10h)	2336	(10h)	2336	(10h)
Header Only	20h	(10h)	4	4	4	4
Header Only + EDC/ECC	28h	(10h)	Illegal	Illegal	Illegal	Illegal
Header & User Data	30h	(10h)	2052	2340	Illegal	Illegal
Header & User Data + EDC/ECC	38h	(10h)	2344	(30h)	Illegal	Illegal
Sub Header Only	40h	(10h)	8	8	8	8
Sub Header Only + EDC/ECC	48h	(10h)	Illegal	Illegal	Illegal	Illegal
Sub Header & User Data	50h	(10h)	(10h)	(10h)	2056	2336
Sub Header & User Data + EDC/ECC	58h	(10h)	(10h)	(10h)	2344	(50h)
All Headers Only	60h	(10h)	12	12	12	12
All Headers Only + EDC/ECC	68h	(10h)	Illegal	Illegal	Illegal	Illegal
All Headers & User Data	70h	(10h)	(30h)	(30h)	2060	2340
All Headers & User Data + EDC/ECC	78h	(10h)	(30h)	(30h)	2340	2340
Sync & User Data	90h	(10h)	Illegal	Illegal	Illegal	Illegal
Sync & User Data + EDC/ECC	98h	(10h)	Illegal	Illegal	Illegal	Illegal
Sync & Header Only	A0h	(10h)	16	16	16	16
Sync & Header Only + EDC/ECC	A8h	(10h)	Illegal	Illegal	Illegal	Illegal
Sync & Header & User Data	B0h	(10h)	2064	2352	Illegal	Illegal
Sync & Header & User Data + EDC/ECC	B8h	(10h)	2344	(30h)	Illegal	Illegal
Sync & Sub Header Only	C0h	(10h)	Illegal	Illegal	Illegal	Illegal
Sync & Sub Header Only + EDC/ECC	C8h	(10h)	Illegal	Illegal	Illegal	Illegal
Sync & Sub Header & User Data	D0h	(10h)	(10h)	(10h)	Illegal	Illegal
Sync & Sub Header & User Data + EDC/ECC	D8h	(10h)	(10h)	(10h)	Illegal	Illegal
Sync & All Headers Only	E0h	(10h)	24	24	24	24
Sync & All Headers Only + EDC/ECC	E8h	(10h)	Illegal	Illegal	Illegal	Illegal
Sync & All Headers & User Data	F0h	(10h)	2064	2352	2072	2352
Sync & All Headers & User Data + EDC/ECC	F8h	(10h)	2352	(F0h)	2352	(F0h)
Repeat All Above and Add Error Flags	02h	294	294	294	294	294
Repeat All Above and Add Block & Error Flags	04h	296	296	296	296	296

The lengths of the data returned from the READ CD command vary based on the type of sector that is being read and the requested fields to be returned to the Host. Many combinations are possible, but most are not very usefull. Table 96, "Number of Bytes Returned Based on Data Selection Field," on page 142 specifies how the drive responds to many of the requests possible. Requests for transfers not specified by this table *shall* not be supported and treated as Illegal. Illegal values will cause the command to be aborted with a CHECK Condition, Sense Key 05, ASC 24 (INVALID FIELD IN COMMAND PACKET).

The Values in () indicate that the amount of data is the same as the Flag byte setting specified by the contents of the parenthesis.

Values that are shaded are most usefull to the host and *shall* return the number of bytes specified if supported.

See "*Figure 11 - CD-ROM Sector Formats*" on page 73 for a description of the data available for each sector type.

***C-57 Section 10.8.15, page 143***

Remove the sentence "The number of bytes returned..." after table 97.

***C-58 Section 10.8.16, page 149***

Section 10.8.16 - Read CD MSF Command - repeat Read CD introductory text.

**C-59 Section 10.8.18.2, page 161**

Replace the first paragraph after Table 119 with:

I1, I2 are the country code; I3, I4, I5 are the owner code and are returned as is from the media; I6, I7 are the year of recording; I8, I9, I10, I11, I12 are the serial number of the recording. The characters from I1 to I5 are coded in a 6-bit format as given below; the characters from I6 to I12 are 4-bit BCD numbers. AFrame is the absolute frame number.

Replace the text and table 120 with the following:

I1, I2 are the country code; I3, I4, I5 are the owner code; I6, I7 are the year of recording; I8, I9, I10, I11, I12 are the serial number of the recording. AFrame is the absolute frame number.

Note: The information returned for the ISRC may be returned as is from the media, or in some cases it may be converted to ASCII. It is recommended that the drive convert the information to ASCII.

**Table 120 - ISRC Format of Data Returned to Host**

Bit Byte	7	6	5	4	3	2	1	0
8	TCVal	Reserved						
9				I1 (Country Code)				
10				I2				
11				I3 (Owner Code)				
12				I4				
13	Note: The shaded Bits are used if the drive converts the data returned to ASCII			I5				
14				I6 (Year of Recording)				
15				I7				
16				I8 (Serial Number)				
17				I9				
18				I10				
19				I11				
20				I12				
21	Zero							
22	AFrame							
23	Reserved							

**C-60 Section 10.8.19, page 166**

Change the Table and following description to:

**Table 122 - READ TOC Command**

Bit Byte	7	6	5	4	3	2	1	0
0	Operation code (43h)							
1	Reserved						MSF (Mandatory)	Reserved
2	Reserved					Format		
3	Reserved							
4	Reserved							
5	Reserved							
6	Starting Track / Session Number							
7	Allocation Length							
8								
9	Format		Reserved					
10	Reserved							
11	Reserved							

See "8.6 CD-ROM Address Reporting Formats (MSF bit)" on page 78 for a description of the MSF bit. Support for the MSF bit is mandatory.

To identify the multi-session CD TOC, the most significant 2 bits of the byte at offset 9 (Format) have been assigned to identify this information. For handling multi-session and/or the Kodak PhotoCD, format 01b can be used. For drives that do not support multi-session, the First session number should be equal to the Last session number in the returned TOC information. Format field definition: When Format in Byte 2 is zero, then Byte 9 is used. Other values for this field are reserved for definition in MMC.

*Note: The Format field in Byte 9 is a vendor-specific area and will be removed in subsequent versions of this specification. Functionality is moving to Byte 2.*

00b Mandatory

This mode is a backward compatible mode where the starting track field specifies the starting track number for which the data *shall* be returned. If this value is zero, the table of contents data *shall* begin with the first track on the medium. The data are returned in contiguous ascending track number order.

01b Mandatory

Multi-session mode and returns the first session number, last session number and last session address. In this format the Starting Track is reserved.

10b Mandatory

Returns all Sub-channel Q data in the lead in (TOC) area, starting from a specified session number as specified in the Session Number Field. In this mode, the drive will support Q Subcode Point field values of A0h, A1h, A2h; Track Numbers of B0h, B1h, B2h, B3h, B4h and C0h.

11b

Reserved

**C-61 Section 10.8.19, page 165**

Add the following after Table 124:

The TOC Data Length *shall* be 10 (0Ah).

**C-62 Section 10.8.19, page 166**

Replace Table 125 and text with the following:

**Table 125 - Read TOC Data Format (With Format Field = 10b)**

Bit Byte	7	6	5	4	3	2	1	0
0	MSB TOC Data Length (2 + (11 * The number of Descriptors returned)) LSB							
1								
2	First Session Number							
3	Last Session Number							
TOC Track Descriptors								
0	Session Number							
1	ADR				Control			
2	TNO (0)							
3	Point							
4	Byte 3 or Min							
5	Byte 4 or Sec							
6	Byte 5 or Frame							
7	Byte 6 or Zero							
8	Byte 7 or PMin							
9	Byte 8 or PSec							
10	Byte 9 or PFrame							

See Table 131, "Lead in Area (TOC), Sub-channel Q formats," on page 173 and section 10.8.19.2 on page 175 for a detailed description of bytes 2-10 above.

The returned TOC data of a multi-session disc is arranged in ascending order of the session number. The TOC data within a session is arranged in the order of Q Subcode Point Field value of A0h, A1h, A2h; Track Numbers B0h, B1h, B2h, B3h, B4h and C0h.

The TOC data returned shall be sorted according to the following rules:

1. Each session of a multisession disk shall be returned independently. No mixing of any of the pointers from each session shall occur.
2. The first TOC entries shall be the A0, A1, A2h pointers from the session. Note that in many cases these pointers are placed at the end of the actual TOC data on the media.
3. Following the Ax pointers will be all the Track Pointer entries.
4. Last will be any Bx, Cx or other reserved value pointers.

**C-63 Section 10.8.19, page 166**

Add the following table after table 123:

**Table 1 - TOC Track Descriptors**

Byte	Action	Description
Byte 0	Return a hex value	Session Number
Byte 1	No conversion, return as is	ADR / Cntrl
Byte 2	0	Track (TOC = 0)
Byte 3	If 0-99, then conver to hex	Point
Bytes 4 - 6	Conversion based on Point	MSF Field
Point 00-99	Value should be 00h	NRA Skip Values ORP / App Code Reserved
Point A0h - AFh	Value should be 00h	
Point B0h	Convert to hex	
Point B1h - BFh	Convert to hex	
Point C0	No Conversion	
Point C1 - FFh	No Conversion	
Byte 7	Conversion based on Point	ZERO Field
Point 00h - AFh	Value should be 00h	
Point B0h - BFh	Convert to Hex	# Pntrs / Skip
Point C0h - FFh	No Conversion	Reserved
Bytes 8 - 10	Conversion based on Point	ZERO Field
Point 00 - 99	Convert to hex	Track Start
Point A0h	Convert PMIN to hex, PSEC is retruned as is	1st / Last / Start LO
Point A1h - AFh	Convert to hex	1st / Last / Start LO
Point B0h	Convert to hex	Lead Out Max
Point B1h - BFh	Convert to hex	Skip Values
Point C0h	Convert to hex	ORP / App Code
Point C1h - FFh	No conversion	Reserved

**C-64 Section 10.8.19.1**

Change ATIME contents in the Min, Sec, Frame fields for the first 3 entries in Table 127 to "00 (Absolute time allowed)".

**C-65 Section 10.8.19.2, page 169**

Example Read TOC Operations - Update Table 130, Example Read TOC Operations.

**Table 130 - Example Read TOC Operations**

Ses	A/C	TNO	Pnt	Min Sec Frame	Zero	PMin PSec PFrame	Comments
01	14	00	A0	00 00 00	00	01 20 00	First track is 1. XA disc
01	14	00	A1	00 00 00	00	03 00 00	Last track is 3
01	14	00	A2	00 00 00	00	02 08 3F	Lead Out Area on 1st session

**Table 130 - Example Read TOC Operations**

Ses	A/C	TNO	Pnt	Min Sec Frame	Zero	PMin PSec PFrame	Comments
01	14	00	01	00 00 00	00	00 02 00	Start address of track 1
01	14	00	02	00 00 00	00	00 08 02	Start address of track 2
01	14	00	03	00 00 00	00	00 15 32	Start address of track 3
01	54	00	B0	04 26 3F	02	40 02 00	Next recordable area address
01	54	00	C0	C0 00 00	00	61 2C 00	Hybrid disc
02	14	00	A0	00 00 00	00	04 20 00	1st track on 2nd session is 4
02	14	00	A1	00 00 00	00	06 00 00	Last track on 2nd session is 6
02	14	00	A2	00 00 0	00	08 20 08	Lead Out Area on 2nd session
02	14	00	04	00 00 00	00	04 28 3F	Start address of track 4
02	14	00	05	00 00 00	00	04 2E 41	Start address of track 5
02	14	00	06	00 00 00	00	06 27 36	Start address of track 6
02	54	00	B0	09 2C 08	01	40 02 00	Next recordable area address
03	14	00	A0	00 00 00	00	07 20 00	1st track on 3rd session is 7
03	14	00	A1	00 00 00	00	09 00 00	Last track on 3rd session is 9
03	14	00	A2	00 00 00	00	0C 27 32	Lead Out Area on 3rd session
03	14	00	07	00 00 00	00	09 2E 08	Start address of track 7
03	14	00	08	00 00 00	00	09 34 10	Start address of track 8
03	14	00	09	00 00 00	00	0B 04 24	Start address of track 9
03	54	00	B0	20 09 32	01	40 02 00	Next recordable area address
04	14	00	A0	00 00 00	00	0A 20 00	1st track on 4th session is 10
04	14	00	A1	00 00 00	00	0C 00 00	Last track on 4th session is 12
04	14	00	A2	00 00 00	00	12 1B 1A	Lead Out Area on 4th session
04	14	00	0A	00 00 00	00	0E 0B 32	Start address of track 10
04	14	00	0B	00 00 0	00	0E 11 34	Start address of track 11
04	14	00	0C	00 00 00	00	11 08 22	Start address of track 12
04	54	00	B0	13 39 1A	01	40 02 00	Next recordable area address

**C-66 Section 10.8.19.2, page 170**

Replace the example at the top of the page with:

If you use the following command on this disc, Command Packet: 43h 00 00 00 00 00 00h 10h 00 40h 00 00, return data would be:

**C-67 Section 10.8.20, page 171**

Change the 4th paragraph to:

The ATAPI CD-ROM Drive *shall* return CHECK CONDITION status for a REQUEST SENSE command only to report exception conditions specific to the command itself. For example:

1. An ATAPI CD-ROM Drive malfunction prevents return of the sense data.

**C-68 Section 10.8.23, page 185**

SET CD Speed Command - add sentence after 2nd paragraph: "If the speed selected is less than 1x, then the drive *shall* reject the command, and not change the speed."

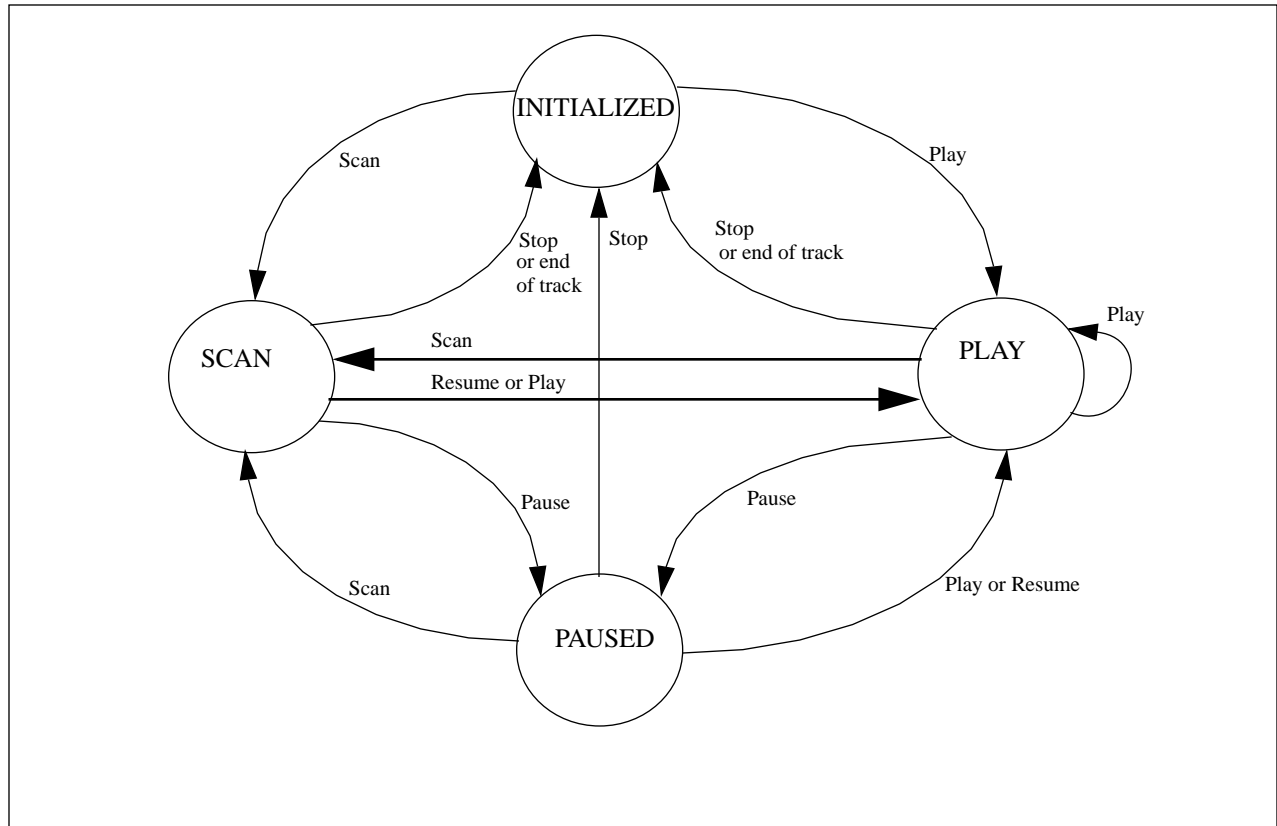
**C-69 Section 10.8.20.3, page 176**

Table 137 - Add "Media Load/Eject Failed (05,01)"

Table 137 - ASC and ASCQ Assignments - remove "3F Inquiry Data Has Changed"

**C-70 Section 10.8.20.4, page 188**

Replace Figure 14 with:



**C-71 Section 10.8.26, page 192**

Replace Table 155 with the following:

**Table 155 - Recommended Sense Key, ASC and ASCQ for MODE SELECT Command Errors**

Sense Key	ASC	ASCQ	Description of Error
00	00	00	NO ADDITIONAL SENSE INFORMATION
05	20		INVALID COMMAND OPERATION CODE
05	24		INVALID FIELD IN COMMAND PACKET
02	04	00	LOGICAL DRIVE NOT READY - CAUSE NOT REPORTABLE
02	04	01	LOGICAL DRIVE NOT READY - IN PROGRESS OF BECOMING READY
02	04	02	LOGICAL DRIVE NOT READY - INITIALIZING COMMAND REQUIRED
02	04	03	LOGICAL DRIVE NOT READY - MANUAL INTERVENTION REQUIRED
02	06	00	NO REFERENCE POSITION FOUND (media may be upside down)
02	30	00	INCOMPATIBLE MEDIUM INSTALLED
02	30	01	CANNOT READ MEDIUM - UNKNOWN FORMAT
02	30	02	CANNOT READ MEDIUM - INCOMPATIBLE FORMAT
02	3A		MEDIUM NOT PRESENT

*Note: Some drives return ASC/ASCQ with audio, status and sense code 00 when there is no error condition.*



